MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

DCS5068 – DATA STRUCTURE AND ALGORITHMS

(DIT Group)

17 OCTOBER 2015
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT:

1. This question paper consists of **FIVE (5)** pages excluding the cover page. There are **TWO (2)** sections in this booklet.

2. **SECTION A**: There are **THREE (3)** structured questions in this section. Answer **ALL** questions in the answer booklet provided.

3. **SECTION B**: There are **TWO (2)** questions in this section. Answer **ONLY ONE (1)** question in the answer booklet provided.

SECTION A (75 Marks)

Instruction: *Answer all questions in the answer booklet provided.*

QUESTION 1 (25 Marks)

a. Write the output of the following C++ program. [8 marks]

```
#include <iostream>
using namespace std;

typedef int *IntPtrType;

int main()
{
    IntPtrType ptr_a, ptr_b, *ptr_c;

    ptr_a = new int;
    *ptr_a = 17;
    ptr_b = ptr_a;
    cout << *ptr_a << " " << *ptr_b << "\n";
    ptr_b = new int;
    *ptr_b = 9;
    cout << *ptr_a << " " << *ptr_b << "\n";
    *ptr_b = *ptr_a;
    cout << *ptr_a << " " << *ptr_b << "\n";
    delete ptr_a;
    ptr_a = ptr_b;
    cout << *ptr_a << " " << *&*&*&*&*ptr_b << "\n";
    ptr_c = &ptr_a;
    cout << *ptr_c << " " << **ptr_c << "\n";
    delete ptr_a;
    ptr_a = NULL;

    return 0;
}
```

b. Which of the statements in the following code is incorrect?

[1 mark]

```
int *A = new int[5];
for(int i=0; i<5; i++) A[i] = i;
int *B = A;
delete [] A;
B[0] = 1;
```


Continued.....

c. Answer the following instructions below. [8 marks]

i. Create a class called **Rectangle** to calculate the area. In the class declare *width* and *height* with a type integer. Declare a function *set_values(...)* that will take two parameter values with the type integer. Declare the area function that has return data type of area calculations.

ii. Create constructor of Rectangle class that initialize variable *width=a* and *height=b*.

d. Convert the following Infix expression to **Prefix expression** and **Postfix expression**.

[8 marks]

i. A + ((B - C * D) / E) + F - G / H

ii. (A * B + C) / D - E / (F + G)

QUESTION 2 (25 Marks)

a. Complete the ***buildForward()*** function below in order to add a new node at the end of the linked list. [12 marks]

```
nodeType *buildForward( )
{
   nodeType *first, *newNode, *last;
   int num;
   cout<<"Enter a list of integers ending with -999.\n"
   cin>>num;
     _____________________________
     _____________________________
     _____________________________
     _____________________________

    cin>>num; }
    return first;
}
```

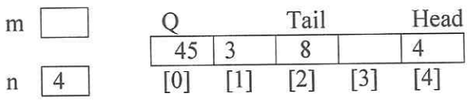
b. Suppose Q is a cyclic queue of integers with **five elements**. Two integers **m** and **n** are also declared. Based on the following code execution, draw a **sequence diagram** of **Q**, **m** and **n.** Given are function append to add data into queue and function serve to remove data from queue. [7 marks]

ADTqueue Q;

i. Q.append (19-n);
ii. m = Q.serve ()*n;

Continued.....

iii. Q.append (n);
iv. n=Q.serve () % m;
v. Q.append (8);
vi. n+=Q.serve ();
vii. Q.append (m);



c. Convert the following infix expression to a postfix expression using stack. [4 marks]

(X – Y * J / (K – L) + M)

d. List and describe **TWO (2)** basic command operations that you would expect to be provided in a specification of a *Stack* ADT. [2 marks]

QUESTION 3 (25 Marks)

a. Write the **Quicksort** pseudocode. [5 marks]

b. Write a full ***hash_function(…)*** to truncate the first two digits and last digit. Given the key is **3567**. [3 marks]

c. Write a hash function and give the answer based on the following instructions below.

Key: 73459362

i. Truncate the last 3 digits of the key. [3 marks]

ii. Truncate the first 2 digits and the last 2 digits of the key. [3 marks]

d. Assume a hash table with **8** locations and the hashing function **h(x) = x % 7**. Show the index for each key and the result of the hash table when the following integers are inserted in the order given. Use **Quadratic Probing** to solve the collision. [11 marks]

31, 16, 74, 60, 22, 40

Continued…….

SECTION B (25 Marks)

Instruction: *Choose and answer* ***ONLY ONE (1)*** *question from this section and write your answers in the answer booklet provided.*

QUESTION 1 (25 Marks)

a. Write a C++ code for function **Inorder Traversal** in a binary tree. [5 marks]

b. By using **binary search**, show the step in searching the data **9** in the array given. Show all the steps to depict the process. [9 marks]

Index	0	1	2	3	4	5	6	7	8	9
Array	9	14	22	35	43	47	52	68	73	91

c. Draw a **binary tree** for the algebraic expression shown below:

[7 marks]

a * (7 * (x - 8)) – (9 / (y + 11))

i. From the binary tree, derive the **Preorder** algebraic expression.

[2 marks]

ii. From the binary tree, derive the **Postorder** algebraic expression.

[2 marks]

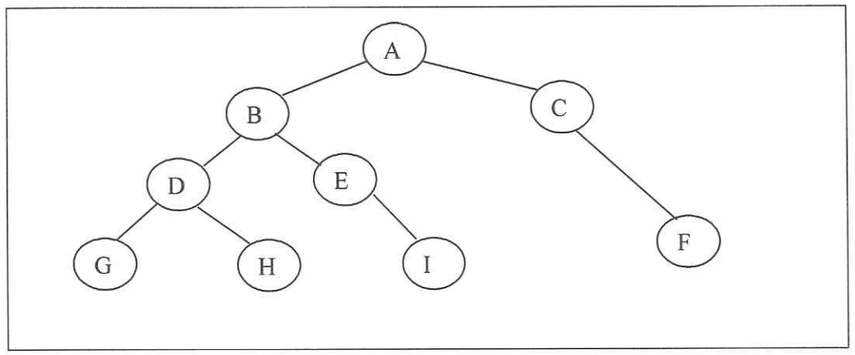
QUESTION 2 (25 Marks)

a. Draw a graph to represent given adjency matrix [8 marks]

	a	b	c	d	e	f	g	h
a	∞	7	5	6	∞	∞	∞	∞
b	7	∞	2	∞	∞	∞	4	∞
c	5	2	∞	∞	4	8	∞	∞
d	6	∞	∞	∞	9	∞	∞	∞
e	∞	∞	4	9	∞	1	∞	∞
f	∞	∞	8	∞	1	∞	9	10
g	∞	4	∞	∞	∞	9	∞	3
h	∞	∞	∞	∞	∞	10	3	∞

Continued.....

b. Answer the following instructions based on the figure given below.



i. Write the output using **Breadth First Search** (BFS)Algorithm

[4.5 marks]

ii. Write the output using **Depth First Search** (DFS)Algorithm

[4.5 marks]

c. Create an instance of the structure called ***node*** define the data type integer for a node in a binary tree. [2 marks]

d. Given below is an array containing **8** elements. Shown in the step by step process, how the array is sorted in **ascending** order using **Merge Sort**. [6 marks]

110	18	53	45	3	41	34	27

End of Page.